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(54) BRAZING SHEET FOR HEAT EXCHANGER, EXCELLENT CORROSION RESISTANCE AND BRAZABILITY

(57)Abstract:
PURPOSE: To provide a brazing sheet for heat exchanger, excellent in brazability and corrosion resistance.
CONSTITUTION: One side of an Al-Mn type Al alloy core material is clad with an Al-Si type Al alloy brazing filler metal. Further, the other side of the core material is clad with a sacrificial anode cladding material of Al alloy having a composition consisting of, by weight, 0.5-3% Mg, 0.0005-0.1% Be, 0.05-1.5% Mn, and the balance Al with inevitable impurities or a sacrificial anode cladding material of Al alloy having a composition consisting of 0.5-3% Mg, 0.0005-0.1% Be, 0.05-1.5% Mn, further one or ≥ 2 kinds among 1-12% Zn, 0.005-0.1% In, and 0.01-0.3% Sn.

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CLAIMS

[Claim(s)]
[Claim 1] The brazing sheet for heat exchangers excellent in the corrosion resistance and soldering nature which are characterized by carrying out the clad of the aluminum-Si system aluminum alloy wax material to one side of an aluminum-Mn system aluminum alloy core material, and coming to carry out the clad of the aluminum alloy sacrificial anode hide material which has the presentation which Mg:0.5-3%, Be:0.0005-0.1%, and Mn:0.05-1.5% are contained on one side of another side of said core material, and the remainder becomes on it from aluminum and an unescapable impurity by weight %.
[Claim 2] The clad of the aluminum-Si system aluminum alloy wax material is carried out to one side of an aluminum-Mn system aluminum alloy core material. On one side of another side of said core material by weight % Mg: 0.5-3%, Be:0.0005-0.1%, Mn:0.05-1.5%, It contains. Further Zn:1-12%, In:0.005-0.1%, Sn:0.01-0.3% and ** -- the brazing sheet for heat exchangers excellent in the corrosion resistance and soldering nature which are characterized by coming to carry out the clad of the aluminum alloy sacrificial anode hide material which has the presentation which becomes since one sort or two sorts or more are contained and the remainder consists of aluminum and an unescapable impurity.
[Claim 3] Said aluminum-Mn system aluminum alloy core material is the brazing sheet for heat exchangers excellent in the corrosion resistance according to claim 1 or 2 and soldering nature which are characterized by being weight % and being aluminum alloy core material of the presentation which Mn:0.8-1.3%, Si:0.3-1.0%, Cu:0.05-0.7%, Zr:0.05-0.2%, and Ti:0.05-0.2% are contained, and the remainder becomes from aluminum and an unescapable impurity.
[Claim 4] Said aluminum-Mn system aluminum alloy core material is the brazing sheet for heat exchangers excellent in the corrosion resistance according to claim 1 or 2 and soldering nature which are characterized by being weight % and being aluminum alloy core material of the presentation which Mn:0.8-1.3%, Si:0.3-1.0%, Cu:0.05-0.7%, Zr:0.05-0.2%, Ti:0.05-0.2%, and Mg:0.05-0.3% are contained, and the remainder becomes from aluminum and an unescapable impurity.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the brazing sheet for heat exchangers of an automobile especially about the brazing sheet excellent in the corrosion resistance and soldering nature which are used as various structural elements, such as a heat exchanger.
[0002]
[Description of the Prior Art] It is JIS 3003 (at % of the weight) as a brazing sheet for the former and heat exchangers. Mn: 1.0-1.5%, Cu:0.05-0.20%, less than [Si:0.6%], The clad of the aluminum-Si system aluminum alloy wax material is carried out to one side of less than [Zr:0.7] %, less than [Zn:0.10] %, remainder:aluminum, and an unescapable impurity aluminum-Mn system alloy core material. aluminum alloy sacrificial anode hide material which contains Mg:0.3-2.5% on one side of another side of this core material, Mg: aluminum alloy sacrificial anode hide material or Mg:0.3-2.5% which contains less than [Zn:2%] 0.3-2.5%, Mn: The brazing sheet for heat exchangers which comes to carry out the clad of the aluminum alloy sacrificial anode hide material which contains 0.2-1.5% and contains less than [Cu:0.5%], less than [Cr:0.3%], and less than [Zr:0.2%] further is known (for example, refer to JP,2-175093,A).
[0003]
[Problem(s) to be Solved by the Invention] However, said JIS The clad of the aluminum-Si system aluminum alloy wax material which contains Si in one side of aluminum-Mn system aluminum alloy core materials, such as 3003, is carried out. The conventional brazing sheet for heat exchangers which comes to carry out the clad of the aluminum alloy sacrificial anode hide material containing Mg:0.3-2.5% to one side of another side of a core material (a) When a firm oxide skin is easy to be formed in aluminum alloy sacrificial anode hide material which contains Mg at the time of soldering heating, consequently the sacrificial anode effectiveness stops being able to act easily, in order only for the comparatively weak part of an oxide skin to corrode alternatively, React to (b) Mg which a through tube tends to produce with flux, and this is made to inactivate. When soldering sacrificial anode ****** directly like the header plate of a radiator from a place with the property to reduce soldering nature, [not to mention] Also in soldering of sacrificial anode hide material and an opposite side, when board thickness was thin, Mg passed the core material by diffusion, arrived at the wax material side, and soldering was checked, therefore there were problems, such as becoming the failure of thinning.
[0004]
[Means for Solving the Problem] Then, the result of having inquired so that this invention persons may get the brazing sheet for heat exchangers which excelled before in corrosion resistance and soldering nature from this viewpoint, (b) If Be has the operation which controls oxide skin generation of an aluminum-Mg alloy and Be is added to the sacrificial anode hide material of an aluminum-Mg alloy Since the sacrificial anode effectiveness of sacrificial anode hide material improves further and it corrodes in homogeneity, it is hard to produce pitting. If soldering nature is not checked but Mn is further added to the sacrificial anode hide material containing Mg and Be in order for Be to have the

operation which controls the reaction of Mg and flux furthermore and not to reduce an operation of flux The oxide skin growth at the time of soldering of sacrificial anode hide material is controlled further, and it follows. The sacrificial anode hide material which added Mn to Mg and Be, and coincidence is (b) which raises soldering nature and the sacrificial anode effectiveness further. The content of Mg, Be, and Mn which are added to sacrificial anode hide material It is in Mg:0.5-3%, Be:0.0005-0.1%, and Mn:0.05-1.5% of within the limits. Furthermore, 1 of Zn:1-12%, In:0.005-0.1%, and Sn:0.01-0.3% of sorts and two sorts or more were contained if needed, and knowledge, like it is desirable having the presentation which becomes since the remainder consists of aluminum and an unescapable impurity was acquired.

[0005] This invention is accomplished based on this knowledge, and is weight %. (1) The clad of the aluminum-Si system aluminum alloy wax material is carried out to one side of an aluminum-Mn system aluminum alloy core material. On one side of another side of said core material by weight % Mg:0.5-3%, Be:0.0005-0.1%, and Mn:0.05-1.5% are contained. The brazing sheet for heat exchangers excellent in the corrosion resistance and soldering nature which come to carry out the clad of the aluminum alloy sacrificial anode hide material which has the presentation which the remainder becomes from aluminum and an unescapable impurity, (2) The clad of the aluminum-Si system aluminum alloy wax material is carried out to one side of an aluminum-Mn system aluminum alloy core material. On one side of another side of said core material by weight % Mg:0.5-3%, Be:0.0005-0.1%, and Mn:0.05-1.5% are contained. Furthermore, 1 of Zn:1-12%, In:0.005-0.1%, and Sn:0.01-0.3% of sorts and two sorts or more are contained. It has the description in the brazing sheet for heat exchangers excellent in the corrosion resistance and soldering nature which come to carry out the clad of the aluminum alloy sacrificial anode hide material which has the presentation which becomes since the remainder consists of aluminum and an unescapable impurity.

[0006] The aluminum-Mn system aluminum alloy core material used with the brazing sheet of this invention Although not limited especially, it is (i) at weight %. Mn:0.8-1.3%, Si: 0.3-1.0%, Cu:0.05-0.7%, Zr:0.05-0.2%, Ti: aluminum alloy core material of the presentation which 0.05-0.2% is contained and the remainder becomes from aluminum and an unescapable impurity, (ii) Mn:0.8-1.3%, Si:0.3-1.0%, Cu:0.05-0.7%, Zr: It is desirable that it is aluminum alloy core material of the presentation which 0.05-0.2%, Ti:0.05-0.2%, and Mg:0.05-0.3% are contained, and the remainder becomes from aluminum and an unescapable impurity.

[0007] Therefore, it sets to a brazing sheet the above (1) or given in (2), and the brazing sheet for heat exchangers of this invention is the above (i) about a core material. It has the description to also consider as aluminum alloy core material of - (ii). It is much more desirable to use aluminum alloy core material of the above (ii) in the brazing sheet of the above (1) also in it, and it sets to the brazing sheet of the above (2) further, and is the above (i). It is much more desirable to use aluminum alloy core material.

[0008] As for especially the brazing sheet excellent in the corrosion resistance of this invention, and soldering nature, using as a structural member of a heat exchanger is desirable, and it is desirable to use as a brazing sheet for heat exchangers of an automobile especially. Next, the reason which limited the component presentation of the brazing sheet for heat exchangers excellent in the soldering nature of this invention and corrosion resistance like **** is explained.

[0009] (A) Sacrificial anode hide material Mg : Mg of sacrificial anode hide material is a component which raises reinforcement while raising the pitting-proof nature of sacrificial anode hide material, but since the effectiveness of a request of the content at less than 0.5% is not acquired, but 3% will be exceeded on the other hand and a sex falls, it is not desirable. Therefore, the content of Mg in sacrificial anode hide material was defined to 0.5 - 3%. The much more desirable range of the content of Mg is 1.0 - 2.0%.

[0010] Although Be:Be is cursed among sacrificial anode hide material, controls the oxide skin growth at the time, and has the operation which raises pitting-proof nature and there is an operation which the reaction of Mg and flux is controlled further and does not reduce an operation of flux Since the effectiveness of a request of the content at less than 0.0005% is not acquired, much more effectiveness is not acquired on the other hand even if contained exceeding 0.1%, but cost starts too much on the

contrary, it is not desirable. Therefore, it set to Be:0.0005-0.1%. The much more desirable range of the content of Be is 0.001 - 0.005%.
[0011] Although it has the operation which curses among sacrificial anode hide material, controls the oxide skin growth at the time much more effectively, and raises pitting-proof nature by containing with Be, since as for Mn:Mn the effectiveness of a request of the content at less than 0.05% is not acquired, much more effectiveness is not acquired on the other hand even if contained exceeding 1.5%, but cost starts too much on the contrary, it is not desirable. Therefore, it set to Mn:0.05-1.5%. The much more desirable range of the content of Mn is 0.05 - 0.3%.
[0012] Zn, In, Sn : although it adds if needed since each of these components in sacrificial anode hide material is components which make potential of sacrificial anode hide material **, and raise the sacrificial anode effectiveness Even if desired effectiveness is not acquired less than [Zn:1%], less than [In:0.005%], and less than [Sn:0.01%], respectively, but the content exceeds Zn:12% on the other hand, exceeds In:0.1% and being contained exceeding Sn:0.3%, much more effectiveness is not acquired but it becomes a cost rise. Therefore, the content of Zn, In, and Sn in sacrificial anode hide material was defined to Zn:1-12%, In:0.005-0.1%, and Sn:0.01-0.3%, respectively. The much more desirable range of these components is Zn:1-3%, In:0.02-0.05%, and Sn:0.05-0.15%.
[0013] Unescapable impurity: Although the main things of the unescapable impurity contained in the sacrificial anode hide material of the brazing sheet for heat exchangers excellent in the soldering nature of this invention and corrosion resistance are Fe and Si, as for a corrosion resistance viewpoint to those contents, it is desirable to be specified less than [Fe:0.7%] and less than [Si:0.3%].
[0014] thickness [of sacrificial anode hide material]: -- although especially the thickness of sacrificial anode hide material is not what is specified -- the desirable range -- 5- of the board thickness of a brazing sheet -- it is 10 - 20% much more preferably 30%.
[0015] (B) The aluminum-Mn system aluminum alloy core material used with the brazing sheet for heat exchangers of invention of ****** Especially the aluminum-Mn system aluminum alloy core material desirable one layer used with the brazing sheet for heat exchangers of this invention although not limited By weight %, Mn:0.8-1.3%, Si:0.3-1.0%, Cu:0.05-0.7%, Zr: aluminum alloy core material of the presentation which 0.05-0.2% and Ti:0.05-0.2% are contained, and the remainder becomes from aluminum and an unescapable impurity, Mn: It is aluminum alloy core material of the presentation which 0.8-1.3%, Si:0.3-1.0%, Cu:0.05-0.7%, Zr:0.05-0.2%, Ti:0.05-0.2%, and Mg:0.05-0.3% are contained, and the remainder becomes from aluminum and an unescapable impurity etc.
[0016] Although Si has the operation which forms Mg and the Mg2 Si compound which were diffused from sacrificial anode hide material, and raises the reinforcement after soldering, having limited the component presentation of said aluminum-Mn system aluminum alloy core material like **** If desired effectiveness is not acquired less than [Si:0.3%] but it contains on the other hand exceeding Si:1.0% Although it has the operation which is based on the reason which is not desirable, makes potential of a core material ** while Cu will dissolve and shine and raises next reinforcement, and raises corrosion resistance since brazing nature falls If the effectiveness of a request of the content at less than 0.05% is not acquired but it contains on the other hand exceeding 0.7% Although it has the operation which intergranular corrosion susceptibility increases, is based on the reason which is not desirable since corrosion resistance falls, and Zr, Ti, and Mn crystallize or deposit as an intermetallic compound further, and raises the reinforcement after soldering Zr: Less than [0.05%], less than [Ti:0.05%], less than [Mn:0.8%], Then, desired effectiveness is not acquired, but Zr:0.2% is exceeded, Ti:0.2% is exceeded, and on the other hand, since much more effectiveness will not be acquired but it will lead to a cost rise if **** is exceeded, Mn:1.3% is depended on the reason which is not desirable. Furthermore, although it has the operation which adds if needed, and Mg forms a Mg2 Si compound, and raises the reinforcement after soldering further, less than [Mg:0.05%], desired effectiveness is not acquired, but if contained exceeding Mg:0.3%, since brazing nature will fall, on the other hand, it is based on the reason which is not desirable.
[0017] (C) That the aluminum-Si system aluminum alloy wax material used with the brazing sheet for heat exchangers of invention of wax material ** should just be the usual aluminum-Si system aluminum

alloy wax material Since a fluidity will fall on the contrary if it is the component which gives a fluidity, and the effectiveness of a request of the content at less than 5% is not acquired but it contains on the other hand exceeding 15% while lowering the melting point of wax material, especially Si contained in wax material although not limited is not desirable. Therefore, the content of Si in wax material was defined to 5 - 15%. The much more desirable range of the content of Si in wax material is 7 - 11%.

[0018]

[Example] aluminum alloy of the component presentation shown in Table 1 - 2 was dissolved and cast, the ingot was manufactured, hot rolling was performed after homogenization on condition that usual, this ingot was used as the thickness:30mm hot-rolling plate, and sacrificial anode hide material A-U was produced.

[0019]

[Table 1]

種別		成分組成（重量%、残部は不可避不純物を含む）						
		Mg	Be	Mn	Zn	In	Sn	Al
犠牲陽極皮材	A	0.52	0.0027	0.21	—	—	—	残部
	B	1.57	0.0030	0.10	—	—	—	残部
	C	2.90	0.0035	0.24	—	—	—	残部
	D	1.71	0.0006	0.15	—	—	—	残部
	E	1.88	0.0188	0.27	—	—	—	残部
	F	1.46	0.0959	0.09	—	—	—	残部
	G	1.38	0.0045	0.06	—	—	—	残部
	H	1.70	0.0018	1.48	—	—	—	残部
	I	1.90	0.0016	0.09	11.7	—	—	残部
	J	1.54	0.0025	0.12	—	0.024	—	残部
	K	1.33	0.0030	0.21	6.5	—	—	残部

[0020]

[Table 2]

種別		成分組成（重量%、残部は不可避不純物を含む）						
		Mg	Be	Mn	Zn	In	Sn	Al
犠牲陽極皮材	L	1.40	0.0014	0.07	3.1	—	0.01	残部
	M	1.61	0.0027	0.14	1.6	0.05	—	残部
	N	1.81	0.0021	0.28	—	0.01	0.05	残部
	O	1.55	0.0034	0.21	1.1	0.007	0.1	残部
	P	1.48	0.0018	0.19	—	—	0.2	残部
	Q	*0.43	0.0025	0.14	—	—	—	残部
	R	*3.52	0.0030	0.08	—	—	—	残部
	S	1.54	*0.0003	0.24	—	—	—	残部
	T	1.80	0.0033	*0.03	—	—	—	残部
	U	0.92	*—	*—	1.85	—	—	残部

(* mark shows the value from which it has separated from the range of this invention)
[0021] Next, aluminum alloy of the component presentation shown in Table 3 - 4 was dissolved and cast, the ingot was manufactured, hot rolling was performed after homogenization on condition that usual, this ingot was used as the thickness:150mm hot-rolling plate, and core material a-p was produced.

[0022]
[Table 3]

種別		成分組成（重量%、残部は不可避不純物を含む）						
		Mn	Si	Cu	Zr	Ti	Mg	Al
芯材	a	0.88	0.09	0.02	0.05	0.08	—	残部
	b	1.12	0.24	0.16	0.07	0.06	—	残部
	c	1.67	0.41	0.22	0.08	0.07	—	残部
	d	0.81	0.65	0.44	0.11	0.08	—	残部
	e	1.05	0.57	0.42	0.09	0.10	—	残部
	f	1.28	0.52	0.53	0.14	0.13	—	残部
	g	1.01	0.31	0.39	0.13	0.12	—	残部

[0023]
[Table 4]

種別		成分組成（重量%、残部は不可避不純物を含む）						
		Mn	Si	Cu	Zr	Ti	Mg	Al
芯材	h	1.09	0.91	0.44	0.14	0.13	—	残部
	i	1.21	0.57	0.06	0.12	0.14	—	残部
	j	1.14	0.49	0.68	0.10	0.16	—	残部
	k	1.06	0.46	0.43	0.06	0.11	0.14	残部
	l	0.98	0.51	0.38	0.19	0.09	0.27	残部
	m	1.13	0.64	0.41	0.11	0.05	0.23	残部
	n	1.15	0.42	0.39	0.13	0.19	0.18	残部
	o	1.28	0.46	0.53	0.12	0.12	0.06	残部
	p	1.00	0.41	0.46	0.09	0.09	0.10	残部

[0024] Furthermore, aluminum alloy of the component presentation shown in Table 5 was dissolved and cast, the ingot was manufactured, hot rolling was performed after homogenization on condition that usual, this ingot was used as the thickness:20mm hot-rolling plate, and wax material A - O were produced.

[0025]

[Table 5]

種別		成分組成（重量%）	
		Si	Al および不可避不純物
ろう材	ア	7.38	残部
	イ	8.53	残部
	ウ	9.62	残部
	エ	10.88	残部
	オ	12.80	残部

[0026] Sacrificial anode hide material A-U of the component presentation shown in Table 1 - 2, core material a-p of the component presentation shown in Table 3 - 4, Wax material I of the component presentation shown in Table 5 - O in the combination shown in Table 6 - 7 And superposition, It cold-rolls performing [carry out a clad with hot rolling, and] intermediate annealing suitably continuously. Board thickness:0.20mm, The brazing sheet for this invention heat exchangers of a temper H14 (the rate of the last cold rolling: 30%) (It is hereafter called this invention brazing sheet) The brazing sheet 1 for heat exchangers (conventionally henceforth a brazing sheet) was produced 1-16, the brazing sheets 1-4 for comparison heat exchangers (henceforth a comparison brazing sheet), and conventionally.

[0027] These this invention brazing sheets 1-16, the comparison brazing sheets 1-4 and the following corrosion test, the soldering trial, and the tensile test were conventionally performed about the brazing sheet 1, and evaluation of corrosion resistance, soldering nature, and the reinforcement after soldering was performed.

[0028] After heat-treating maintenance for the test piece of a brazing sheet 1 for 5 minutes at 600 degrees C among nitrogen-gas-atmosphere mind supposing soldering to a corrosion test brazing sheet this invention brazing sheets 1-16, the comparison brazing sheets 1-4, and conventionally, it was immersed in 60-degree C 10ppmCu(s)2+ addition tap water, days until it produces a through tube were measured, the result was shown in Table 6 and 7, and the corrosion resistance of the brazing sheet after soldering was evaluated.

[0029] Width of face which carried out soldering trial 1 corrugated processing : 20mm, Board thickness : A brazing sheet 1 is prepared 80-micrometer aluminum alloy fin material of aluminum-1.2% Mn-1.0%Si-1.5%Zn and this invention brazing sheets 1-16 of the same width of face as this fin material, the comparison brazing sheets 1-4, and conventionally. 15 aluminum alloy fin material is contacted to the wax material side of a brazing sheet, as shown in drawing 1 (a). After applying fluoride system flux, after soldering by the saw lock soldering method of the conditions of maintenance, aluminum alloy fin material was lengthened and plucked off for 600 degrees C and 5 minutes among nitrogen-gas-atmosphere mind. The field of the brazing sheet which lengthened and plucked off aluminum alloy fin material is shown in drawing 1 (b). When it attached and the overall length of a line was set to sigmaL,

it cursed when [at which ideal soldering was performed] it would be left behind to the brazing sheet side which lengthened and plucked off this aluminum alloy fin material, and the overall length of a line was set to sigmaL0, sigma L/sigma L0 x100(%) was defined as the rate of junction, and this rate of junction was measured, and that result is shown in Table 6 and 7, it would shine, and the sex was evaluated. The rate of junction of soldering nature is impractical, if neither heat exchange effectiveness nor endurance is influenced greatly and this does not exceed 90%.

[0030] The soldering trial 2 this invention brazing sheets 1-16, the comparison brazing sheets 1-4, and conventionally, combine with a reverse T character mold, and a brazing sheet 1 is contacted, as shown in drawing 2 (a). After applying fluoride system flux, among nitrogen-gas-atmosphere mind, as shown in 600 degrees C on condition that maintenance for 5 minutes at drawing 2 (b), it soldered, it cursed the sacrificial anode hide material side, and the throat depth of the section was measured, and the result is shown in Table 6 and 7, it would shine, and the sex was evaluated.

[0031] After heat-treating maintenance for a brazing sheet 1 for 5 minutes at 600 degrees C among nitrogen-gas-atmosphere mind the tensile test this invention brazing sheets 1-16, the comparison brazing sheets 1-4, and conventionally, the tensile test was performed, the result was shown in Table 6 and 7, and the reinforcement of the brazing sheet after soldering was evaluated.

[0032]

[Table 6]

種別		プレージングシートの構成			貫通に至る日数 (日)	ろう付け性		引張強さ (N/mm^2)
		犠牲陽極皮材	芯材	ろう材		接合率 (%)	のど厚 (μm)	
本発明プレージングシート	1	A	a	ア	28	99.9	465	195
	2	B	b	イ	32	99.9	451	215
	3	C	c	ウ	34	99.5	390	250
	4	D	d	エ	26	99.2	385	228
	5	E	e	オ	36	99.9	488	229
	6	F	f	ア	36	100	495	231
	7	G	g	イ	26	99.9	448	222
	8	H	h	ウ	34	99.8	445	235
	9	I	i	エ	41	99.8	450	219
	10	J	j	オ	37	99.9	444	228
	11	K	k	ア	40	99.7	418	230

[0033]
[Table 7]

種	別	ブレージングシートの構成			貫通に至る日数 (日)	ろう付け性		引張強さ (N/mm²)
		犠牲陽極皮材	芯材	ろう材		接合率 (%)	のど厚 (μm)	
本発明ブレージングシート	12	L	l	イ	38	99.0	391	241
	13	M	m	ウ	40	99.1	398	239
	14	N	n	エ	42	99.6	405	240
	15	O	o	オ	43	99.8	433	237
	16	P	p	ア	40	99.8	415	233
比較ブレージングシート	1	Q	e	イ	14	100	470	156
	2	R	e	ア	36	45.8	65	261
	3	S	e	イ	18	89.8	205	216
	4	T	e	ウ	20	99.9	452	220
従来ブレージングシート1		U	b	エ	19	89.5	202	205

[0034]
[Effect of the Invention] The result shown in Table 6 and 7 shows that this invention brazing sheets 1-16 are [conventionally / a brazing sheet 1] excellent in corrosion resistance and soldering nature. However, the comparison brazing sheets 1-4 are understood that either of the reinforcement after corrosion resistance, soldering nature, and soldering is also inferior. As mentioned above, both the brazing sheets for heat exchangers of this invention are excellent in corrosion resistance and soldering nature, and can greatly contribute to development of industry.

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TECHNICAL FIELD

[Industrial Application] This invention relates to the brazing sheet for heat exchangers of an automobile especially about the brazing sheet excellent in the corrosion resistance and soldering nature which are used as various structural elements, such as a heat exchanger.

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PRIOR ART

[Description of the Prior Art] It is JIS 3003 (being % of the weight) as a brazing sheet for the former and heat exchangers. Mn: 1.0-1.5%, Cu:0.05-0.20%, less than [Si:0.6%], The clad of the aluminum-Si system aluminum alloy wax material is carried out to one side of less than [Zr:0.7] %, less than [Zn:0.10] %, remainder:aluminum, and an unescapable impurity aluminum-Mn system alloy core material. aluminum alloy sacrificial anode hide material which contains Mg:0.3-2.5% on one side of another side of this core material, Mg: aluminum alloy sacrificial anode hide material or Mg:0.3-2.5% which contains less than [Zn:2%] 0.3-2.5%, Mn: The brazing sheet for heat exchangers which comes to carry out the clad of the aluminum alloy sacrificial anode hide material which contains 0.2-1.5% and contains less than [Cu:0.5%], less than [Cr:0.3%], and less than [Zr:0.2%] further is known (for example, refer to JP,2-175093,A).

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] The result shown in Table 6 and 7 shows that this invention brazing sheets 1-16 are [conventionally / a brazing sheet 1] excellent in corrosion resistance and soldering nature. However, the comparison brazing sheets 1-4 are understood that either of the reinforcement after corrosion resistance, soldering nature, and soldering is also inferior. As mentioned above, both the brazing sheets for heat exchangers of this invention are excellent in corrosion resistance and soldering nature, and can greatly contribute to development of industry.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, said JIS The clad of the aluminum-Si system aluminum alloy wax material which contains Si in one side of aluminum-Mn system aluminum alloy core materials, such as 3003, is carried out. The conventional brazing sheet for heat exchangers which comes to carry out the clad of the aluminum alloy sacrificial anode hide material containing Mg:0.3-2.5% to one side of another side of a core material (a) When a firm oxide skin is easy to be formed in aluminum alloy sacrificial anode hide material which contains Mg at the time of soldering heating, consequently the sacrificial anode effectiveness stops being able to act easily, in order only for the comparatively weak part of an oxide skin to corrode alternatively, React to (b) Mg which a through tube tends to produce with flux, and this is made to inactivate. When soldering sacrificial anode ****** directly like the header plate of a radiator from a place with the property to reduce soldering nature, [not to mention] Also in soldering of sacrificial anode hide material and an opposite side, when board thickness was thin, Mg passed the core material by diffusion, arrived at the wax material side, and soldering was checked, therefore there were problems, such as becoming the failure of thinning.

[Translation done.]

MEANS

[Means for Solving the Problem] Then, the result of having inquired so that this invention persons may get the brazing sheet for heat exchangers which excelled before in corrosion resistance and soldering nature from this viewpoint, (b) If Be has the operation which controls oxide skin generation of an aluminum-Mg alloy and Be is added to the sacrificial anode hide material of an aluminum-Mg alloy Since the sacrificial anode effectiveness of sacrificial anode hide material improves further and it corrodes in homogeneity, it is hard to produce pitting. If soldering nature is not checked but Mn is further added to the sacrificial anode hide material containing Mg and Be in order for Be to have the operation which controls the reaction of Mg and flux furthermore and not to reduce an operation of flux The oxide skin growth at the time of soldering of sacrificial anode hide material is controlled further, and it follows. The sacrificial anode hide material ~~which added Mn to Mg and Be,~~ and coincidence is (b) which raises soldering nature and the sacrificial anode effectiveness further. The content of Mg, Be, and Mn which are added to sacrificial anode hide material It is in Mg:0.5-3%, Be:0.0005-0.1%, and Mn:0.05-1.5% of within the limits. Furthermore, 1 of Zn:1-12%, In:0.005-0.1%, and Sn:0.01-0.3% of sorts and two sorts or more were contained if needed, and knowledge, like it is desirable having the presentation which becomes since the remainder consists of aluminum and an unescapable impurity was acquired.

[0005] This invention is accomplished based on this knowledge, and is weight %. (1) The clad of the aluminum-Si system aluminum alloy wax material is carried out to one side of an aluminum-Mn system aluminum alloy core material. On one side of another side of said core material by weight % Mg:0.5-3%, Be:0.0005-0.1%, and Mn:0.05-1.5% are contained. The brazing sheet for heat exchangers excellent in the corrosion resistance and soldering nature which come to carry out the clad of the aluminum alloy sacrificial anode hide material which has the presentation which the remainder becomes from aluminum and an unescapable impurity, (2) The clad of the aluminum-Si system aluminum alloy wax material is carried out to one side of an aluminum-Mn system aluminum alloy core material. On one side of another side of said core material by weight % Mg:0.5-3%, Be:0.0005-0.1%, and Mn:0.05-1.5% are contained. Furthermore, 1 of Zn:1-12%, In:0.005-0.1%, and Sn:0.01-0.3% of sorts and two sorts or more are contained. It has the description in the brazing sheet for heat exchangers excellent in the corrosion resistance and soldering nature which come to carry out the clad of the aluminum alloy sacrificial anode hide material which has the presentation which becomes since the remainder consists of aluminum and an unescapable impurity.

[0006] The aluminum-Mn system aluminum alloy core material used with the brazing sheet of this invention Although not limited especially, it is (i) at weight %. Mn:0.8-1.3%, Si: 0.3-1.0%, Cu:0.05-0.7%, Zr:0.05-0.2%, Ti: aluminum alloy core material of the presentation which 0.05-0.2% is contained and the remainder becomes from aluminum and an unescapable impurity, (ii) Mn:0.8-1.3%, Si:0.3-1.0%, Cu:0.05-0.7%, Zr: It is desirable that it is aluminum alloy core material of the presentation which 0.05-0.2%, Ti:0.05-0.2%, and Mg:0.05-0.3% are contained, and the remainder becomes from aluminum and an unescapable impurity.

[0007] Therefore, it sets to a brazing sheet the above (1) or given in (2), and the brazing sheet for heat

exchangers of this invention is the above (i) about a core material. It has the description to also consider as aluminum alloy core material of - (ii). It is much more desirable to use aluminum alloy core material of the above (ii) in the brazing sheet of the above (1) also in it, and it sets to the brazing sheet of the above (2) further, and is the above (i). It is much more desirable to use aluminum alloy core material.
[0008] As for especially the brazing sheet excellent in the corrosion resistance of this invention, and soldering nature, using as a structural member of a heat exchanger is desirable, and it is desirable to use as a brazing sheet for heat exchangers of an automobile especially. Next, the reason which limited the component presentation of the brazing sheet for heat exchangers excellent in the soldering nature of this invention and corrosion resistance like **** is explained.
[0009] (A) Sacrificial anode hide material Mg : Mg of sacrificial anode hide material is a component which raises reinforcement while raising the pitting-proof nature of sacrificial anode hide material, but since the effectiveness of a request of the content at less than 0.5% is not acquired, but 3% will be exceeded on the other hand and a sex falls, it is not desirable. Therefore, the content of Mg in sacrificial anode hide material was defined to 0.5 - 3%. The much more desirable range of the content of Mg is 1.0 - 2.0%.
[0010] Although Be:Be is cursed among sacrificial anode hide material, controls the oxide skin growth at the time, and has the operation which raises pitting-proof nature and there is an operation which the reaction of Mg and flux is controlled further and does not reduce an operation of flux Since the effectiveness of a request of the content at less than 0.0005% is not acquired, much more effectiveness is not acquired on the other hand even if contained exceeding 0.1%, but cost starts too much on the contrary, it is not desirable. Therefore, it set to Be:0.0005-0.1%. The much more desirable range of the content of Be is 0.001 - 0.005%.
[0011] Although it has the operation which curses among sacrificial anode hide material, controls the oxide skin growth at the time much more effectively, and raises pitting-proof nature by containing with Be, since as for Mn:Mn the effectiveness of a request of the content at less than 0.05% is not acquired, much more effectiveness is not acquired on the other hand even if contained exceeding 1.5%, but cost starts too much on the contrary, it is not desirable. Therefore, it set to Mn:0.05-1.5%. The much more desirable range of the content of Mn is 0.05 - 0.3%.
[0012] Zn, In, Sn : although it adds if needed since each of these components in sacrificial anode hide material is components which make potential of sacrificial anode hide material **, and raise the sacrificial anode effectiveness Even if desired effectiveness is not acquired less than [Zn:1%], less than [In:0.005%], and less than [Sn:0.01%], respectively, but the content exceeds Zn:12% on the other hand, exceeds In:0.1% and being contained exceeding Sn:0.3%, much more effectiveness is not acquired but it becomes a cost rise. Therefore, the content of Zn, In, and Sn in sacrificial anode hide material was defined to Zn:1-12%, In:0.005-0.1%, and Sn:0.01-0.3%, respectively. The much more desirable range of these components is Zn:1-3%, In:0.02-0.05%, and Sn:0.05-0.15%.
[0013] Unescapable impurity: Although the main things of the unescapable impurity contained in the sacrificial anode hide material of the brazing sheet for heat exchangers excellent in the soldering nature of this invention and corrosion resistance are Fe and Si, as for a corrosion resistance viewpoint to those contents, it is desirable to be specified less than [Fe:0.7%] and less than [Si:0.3%].
[0014] thickness [of sacrificial anode hide material]: -- although especially the thickness of sacrificial anode hide material is not what is specified -- the desirable range -- 5- of the board thickness of a brazing sheet -- it is 10 - 20% much more preferably 30%.
[0015] (B) The aluminum-Mn system aluminum alloy core material used with the brazing sheet for heat exchangers of invention of ****** Especially the aluminum-Mn system aluminum alloy core material desirable one layer used with the brazing sheet for heat exchangers of this invention although not limited By weight %, Mn:0.8-1.3%, Si:0.3-1.0%, Cu:0.05-0.7%, Zr: aluminum alloy core material of the presentation which 0.05-0.2% and Ti:0.05-0.2% are contained, and the remainder becomes from aluminum and an unescapable impurity, Mn: It is aluminum alloy core material of the presentation which 0.8-1.3%, Si:0.3-1.0%, Cu:0.05-0.7%, Zr:0.05-0.2%, Ti:0.05-0.2%, and Mg:0.05-0.3% are contained, and the remainder becomes from aluminum and an unescapable impurity etc.

[0016] Although Si has the operation which forms Mg and the Mg2 Si compound which were diffused from sacrificial anode hide material, and raises the reinforcement after soldering, having limited the component presentation of said aluminum-Mn system aluminum alloy core material like **** If desired effectiveness is not acquired less than [Si:0.3%] but it contains on the other hand exceeding Si:1.0% Although it has the operation which is based on the reason which is not desirable, makes potential of a core material ** while Cu will dissolve and shine and raises next reinforcement, and raises corrosion resistance since brazing nature falls If the effectiveness of a request of the content at less than 0.05% is not acquired but it contains on the other hand exceeding 0.7% Although it has the operation which intergranular corrosion susceptibility increases, is based on the reason which is not desirable since corrosion resistance falls, and Zr, Ti, and Mn crystallize or deposit as an intermetallic compound further, and raises the reinforcement after soldering Zr: Less than [0.05%], less than [Ti:0.05%], less than [Mn:0.8%], Then, desired effectiveness is not acquired, but Zr:0.2% is exceeded, Ti:0.2% is exceeded, and on the other hand, since much more effectiveness will not be acquired but it will lead to a cost rise if **** is exceeded, Mn:1.3% is depended on the reason which is not desirable. Furthermore, although it has the operation which adds if needed, and Mg forms a Mg2 Si compound, and raises the reinforcement after soldering further, less than [Mg:0.05%], desired effectiveness is not acquired, but if contained exceeding Mg:0.3%, since brazing nature will fall, on the other hand, it is based on the reason which is not desirable.

[0017] (C) That the aluminum-Si system aluminum alloy wax material used with the brazing sheet for heat exchangers of invention of wax material ** should just be the usual aluminum-Si system aluminum alloy wax material Since a fluidity will fall on the contrary if it is the component which gives a fluidity, and the effectiveness of a request of the content at less than 5% is not acquired but it contains on the other hand exceeding 15% while lowering the melting point of wax material, especially Si contained in wax material although not limited is not desirable. Therefore, the content of Si in wax material was defined to 5 - 15%. The much more desirable range of the content of Si in wax material is 7 - 11%.

[Translation done.]

* NOTICES *

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EXAMPLE

[Example] aluminum alloy of the component presentation shown in Table 1 - 2 was dissolved and cast, the ingot was manufactured, hot rolling was performed after homogenization on condition that usual, this ingot was used as the thickness:30mm hot-rolling plate, and sacrificial anode hide material A-U was produced.
[0019]
[Table 1]

種別		成分組成（重量%、残部は不可避不純物を含む）						
		Mg	Be	Mn	Zn	In	Sn	Al
犠牲陽極皮材	A	0.52	0.0027	0.21	—	—	—	残部
	B	1.57	0.0030	0.10	—	—	—	残部
	C	2.90	0.0035	0.24	—	—	—	残部
	D	1.71	0.0006	0.15	—	—	—	残部
	E	1.88	0.0188	0.27	—	—	—	残部
	F	1.46	0.0959	0.09	—	—	—	残部
	G	1.38	0.0045	0.06	—	—	—	残部
	H	1.70	0.0018	1.48	—	—	—	残部
	I	1.90	0.0016	0.09	11.7	—	—	残部
	J	1.54	0.0025	0.12	—	0.024	—	残部
	K	1.33	0.0030	0.21	6.5	—	—	残部

[0020]

[Table 2]

種別		成分組成（重量%、残部は不可避不純物を含む）						
		Mg	Be	Mn	Zn	In	Sn	Al
犠牲陽極皮材	L	1.40	0.0014	0.07	3.1	—	0.01	残部
	M	1.61	0.0027	0.14	1.6	0.05	—	残部
	N	1.81	0.0021	0.28	—	0.01	0.05	残部
	O	1.55	0.0034	0.21	1.1	0.007	0.1	残部
	P	1.48	0.0018	0.19	—	—	0.2	残部
	Q	*0.43	0.0025	0.14	—	—	—	残部
	R	*3.52	0.0030	0.08	—	—	—	残部
	S	1.54	*0.0003	0.24	—	—	—	残部
	T	1.80	0.0033	*0.03	—	—	—	残部
	U	0.92	*—	*—	1.85	—	—	残部

(* mark shows the value from which it has separated from the range of this invention)
[0021] Next, aluminum alloy of the component presentation shown in Table 3 - 4 was dissolved and cast, the ingot was manufactured, hot rolling was performed after homogenization on condition that usual, this ingot was used as the thickness:150mm hot-rolling plate, and core material a-p was produced.

[0022]
[Table 3]

種別		成分組成（重量%、残部は不可避不純物を含む）						
		Mn	Si	Cu	Zr	Ti	Mg	Al
芯材	a	0.88	0.09	0.02	0.05	0.08	−	残部
	b	1.12	0.24	0.16	0.07	0.06	−	残部
	c	1.67	0.41	0.22	0.08	0.07	−	残部
	d	0.81	0.65	0.44	0.11	0.08	−	残部
	e	1.05	0.57	0.42	0.09	0.10	−	残部
	f	1.28	0.52	0.53	0.14	0.13	−	残部
	g	1.01	0.31	0.39	0.13	0.12	−	残部

[0023]
[Table 4]

種別		成分組成（重量%、残部は不可避不純物を含む）						
		Mn	Si	Cu	Zr	Ti	Mg	Al
芯材	h	1.09	0.91	0.44	0.14	0.13	−	残部
	i	1.21	0.57	0.06	0.12	0.14	−	残部
	j	1.14	0.49	0.68	0.10	0.16	−	残部
	k	1.06	0.46	0.43	0.06	0.11	0.14	残部
	l	0.98	0.51	0.38	0.19	0.09	0.27	残部
	m	1.13	0.64	0.41	0.11	0.05	0.23	残部
	n	1.15	0.42	0.39	0.13	0.19	0.18	残部
	o	1.28	0.46	0.53	0.12	0.12	0.06	残部
	p	1.00	0.41	0.46	0.09	0.09	0.10	残部

[0024] Furthermore, aluminum alloy of the component presentation shown in Table 5 was dissolved and cast, the ingot was manufactured, hot rolling was performed after homogenization on condition that usual, this ingot was used as the thickness:20mm hot-rolling plate, and wax material A - O were produced.

[0025]

[Table 5]

種別		成分組成（重量%）	
		S i	A l および不可避不純物
ろう材	ア	7.38	残部
	イ	8.53	残部
	ウ	9.62	残部
	エ	10.88	残部
	オ	12.80	残部

[0026] Sacrificial anode hide material A-U of the component presentation shown in Table 1 - 2, core material a-p of the component presentation shown in Table 3 - 4, Wax material I of the component presentation shown in Table 5 - O in the combination shown in Table 6 - 7 And superposition, It cold-rolls performing [carry out a clad with hot rolling, and] intermediate annealing suitably continuously. Board thickness:0.20mm, The brazing sheet for this invention heat exchangers of a temper H14 (the rate of the last cold rolling: 30%) (It is hereafter called this invention brazing sheet) The brazing sheet 1 for heat exchangers (conventionally henceforth a brazing sheet) was produced 1-16, the brazing sheets 1-4 for comparison heat exchangers (henceforth a comparison brazing sheet), and conventionally.

[0027] These this invention brazing sheets 1-16, the comparison brazing sheets 1-4 and the following corrosion test, the soldering trial, and the tensile test were conventionally performed about the brazing sheet 1, and evaluation of corrosion resistance, soldering nature, and the reinforcement after soldering was performed.

[0028] After heat-treating maintenance for the test piece of a brazing sheet 1 for 5 minutes at 600 degrees C among nitrogen-gas-atmosphere mind supposing soldering to a corrosion test brazing sheet this invention brazing sheets 1-16, the comparison brazing sheets 1-4, and conventionally, it was immersed in 60-degree C 10ppmCu(s)2+ addition tap water, days until it produces a through tube were measured, the result was shown in Table 6 and 7, and the corrosion resistance of the brazing sheet after soldering was evaluated.

[0029] Width of face which carried out soldering trial 1 corrugated processing : 20mm, Board thickness : A brazing sheet 1 is prepared 80-micrometer aluminum alloy fin material of aluminum-1.2% Mn-1.0%Si-1.5%Zn and this invention brazing sheets 1-16 of the same width of face as this fin material, the comparison brazing sheets 1-4, and conventionally. 15 aluminum alloy fin material is contacted to the wax material side of a brazing sheet, as shown in drawing 1 (a). After applying fluoride system flux, after soldering by the saw lock soldering method of the conditions of maintenance, aluminum alloy fin material was lengthened and plucked off for 600 degrees C and 5 minutes among nitrogen-gas-atmosphere mind. The field of the brazing sheet which lengthened and plucked off aluminum alloy fin material is shown in drawing 1 (b). When it attached and the overall length of a line was set to sigmaL,

it cursed when [at which ideal soldering was performed] it would be left behind to the brazing sheet side which lengthened and plucked off this aluminum alloy fin material, and the overall length of a line was set to sigmaL0, sigma L/sigma L0 x100(%) was defined as the rate of junction, and this rate of junction was measured, and that result is shown in Table 6 and 7, it would shine, and the sex was evaluated. The rate of junction of soldering nature is impractical, if neither heat exchange effectiveness nor endurance is influenced greatly and this does not exceed 90%.

[0030] The soldering trial 2 this invention brazing sheets 1-16, the comparison brazing sheets 1-4, and conventionally, combine with a reverse T character mold, and a brazing sheet 1 is contacted, as shown in drawing 2 (a). After applying fluoride system flux, among nitrogen-gas-atmosphere mind, as shown in 600 degrees C on condition that maintenance for 5 minutes at drawing 2 (b), it soldered, it cursed the sacrificial anode hide material side, and the throat depth of the section was measured, and the result is shown in Table 6 and 7, it would shine, and the sex was evaluated.

[0031] After heat-treating maintenance for a brazing sheet 1 for 5 minutes at 600 degrees C among nitrogen-gas-atmosphere mind the tensile test this invention brazing sheets 1-16, the comparison brazing sheets 1-4, and conventionally, the tensile test was performed, the result was shown in Table 6 and 7, and the reinforcement of the brazing sheet after soldering was evaluated.

[0032]

[Table 6]

種別	ブレージングシートの構成			貫通に至る日数 (日)	ろう付け性		引張強さ (N/mm^2)
	犠牲陽極皮材	芯材	ろう材		接合率 (%)	のど厚 (μm)	
本発明ブレージングシート	1 A	a	ア	28	99.9	465	195
	2 B	b	イ	32	99.9	451	215
	3 C	c	ウ	34	99.5	390	250
	4 D	d	エ	26	99.2	385	228
	5 E	e	オ	36	99.9	488	229
	6 F	f	ア	36	100	495	231
	7 G	g	イ	26	99.9	448	222
	8 H	h	ウ	34	99.8	445	235
	9 I	i	エ	41	99.8	450	219
	10 J	j	オ	37	99.9	444	228
	11 K	k	ア	40	99.7	418	230

[0033]
[Table 7]

種別		ブレージングシートの構成			貫通に至る日数（日）	ろう付け性		引張強さ（N／mm^2）
		犠牲陽極皮材	芯材	ろう材		接合率（%）	のど厚（μm）	
本発明ブレージングシート	12	L	l	イ	38	99.0	391	241
	13	M	m	ウ	40	99.1	398	239
	14	N	n	エ	42	99.6	405	240
	15	O	o	オ	43	99.8	433	237
	16	P	p	ア	40	99.8	415	233
比較ブレージングシート	1	Q	e	イ	14	100	470	156
	2	R	e	ア	36	45.8	65	261
	3	S	e	イ	18	89.8	205	216
	4	T	e	ウ	20	99.9	452	220
従来ブレージングシート1		U	b	エ	19	89.5	202	205

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the explanatory view showing the evaluation approach of the soldering nature by soldering trial.
[Drawing 2] It is the explanatory view showing the evaluation approach of the soldering nature by soldering trial.

[Translation done.]

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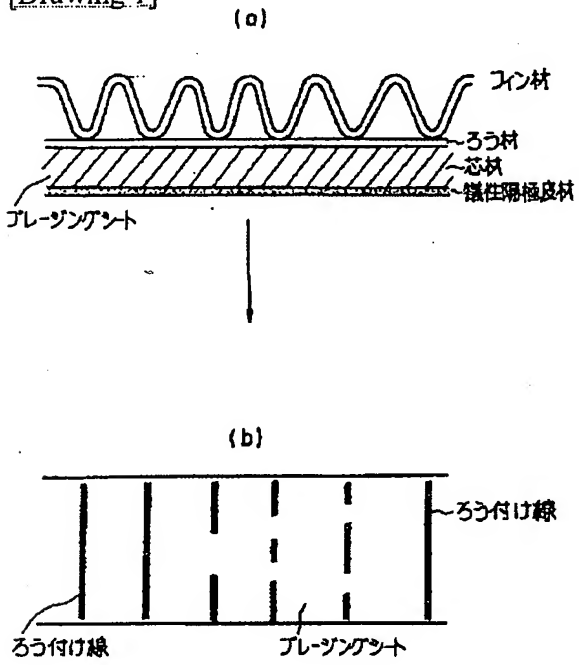
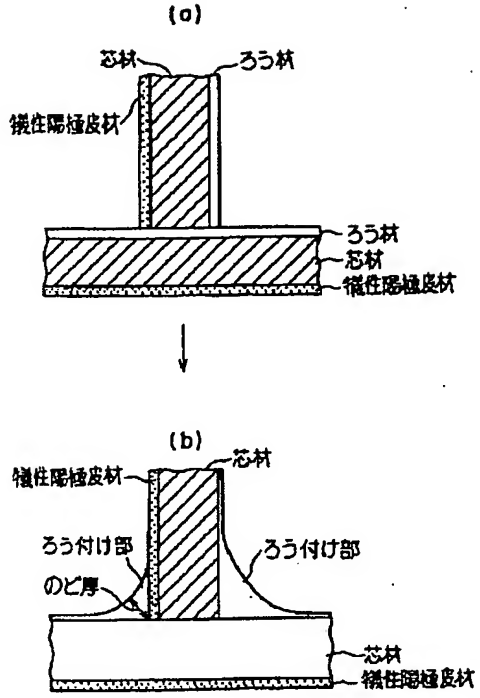
DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]

Japanese Patent App. Pub # 2000-297996

Table 1 (Corrected)

Classification	No.	Solder material composition %	Sacrificial anode composition %	Core material composition %	Soldering performance	Alkali environment Max corroded hole depth μm		Acid environment Max corroded hole depth μm	
Present Invention									
Comparison Example	19					Unable to produce a heat exchanger			
	20					Unable to produce a heat exchanger			
	21					Unable to produce a heat exchanger			
	22					Through			
	23					Unable to produce a heat exchanger			
	24								
	25				Broke during rolling and could not produce.				
	26					Unable to produce a heat exchanger			
	27								
	28				Core material fused during heating for soldering				
	29					Unable to produce a heat exchanger			
Conventional Example						Through			